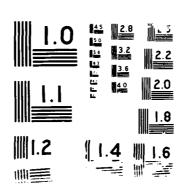
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We have obtained the SIS junctions and RF choke structures which we will use in our experiments. These were fabricated for this project by Dr. Michael Cromar at the National Bureau of Standards Cryoelectronincs Laboratory in Boulder Colorado. We have measured the DC characteristics of these junctions and have found that they have low leakage currents and RC products that are very close to our design goal. We have made preliminary calculations of the SIS mixer conversion effeciency for the real DC characteristics of our junctions and find that the results show the required phase sensitive response.

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Technical Report:

Grant No AFOSR-87-0131

"Phase sensitive amplification with

SIS quasiparticle mixers"

Mark F. Bocko

Department of Electrical Engineering

University of Rochester

Date:

March 28, 1988

In the first year of this grant we have developed a new theoretical framework to predict the behavior of resistive mixers which are pumped by two local oscillators. We have shown that an ideal Superconductor-Insulator-Superconductor tunnel junction mixer which is pumped by two local oscillators can have phase sensitive conversion efficiency. For example, there can be conversion gain for the "cosine" phase of an incoming electromagnetic wave and complete insensitivity to the "sine" phase. Such behavior is required to be able to achieve a mixer noise temperature below the conventionally believed quantum mechanical limit. In the limit of zero power in one of the local oscillators our theory agrees with the conventional quantum theory of mixing. An explicit calculation of the noise of a double pumped mixer is presently under way.

We have obtained the SIS junctions and RF choke structures which we will use in our experiments. These were fabricated for this project by Dr. Michael Cromar at the National Bureau of Standards Cryoelectronics Laboratory in Boulder Colorado. We have measured the DC characteristics of these junctions and have found that they have low leakage currents and RC products that are very close to our design goal. We have made preliminary calculations of the SIS mixer conversion efficiency for the real DC characteristics of our junctions and find that the results show the required phase sensitive response.

The remainder of the experiment is under construction. Our dewar is being built by Infrared Laboratories and a phase coherent, three-frequency millimeter wave source is being constructed for us by Millitech. The mixer block will be a superconducting niobium cavity and is now being designed.



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